Alternative LNG supply systems & bunkering solutions
M/S Stavangerfjord
2018-04-12
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MAN Diesel & Turbo
MAN at a glance
MAN Diesel & Turbo
MAN at a glance

Engines & Marine Systems
- Two-stroke and four-stroke engines for marine applications
- Propellers and complete marine propulsion systems
- Turbochargers

Power Plants
- Two-stroke and four-stroke engines for stationary applications
- Diesel and gas power plants

Turbomachinery
- Compressors, gas and steam turbines, expanders
- Complex machinery trains
- Chemical reactors

Service: MAN PrimeServ
- Worldwide network of service hubs: 24/7 OEM service around the globe
MAN Cryo – the pioneer

GLUTRA 1\textsuperscript{st} Fuel Gas System

SEAGAS 1\textsuperscript{st} Bunker Ship

Icebreaker “POLARIS”, 2 x 400 m\textsuperscript{3}, vertical tanks

Tallink, High speed RoPax ferry, 2 x 300 m\textsuperscript{3}, horizontal tanks

SeaRoad, RoRo ferry, mobile LNG tanks, exchanged via trailers

MAN Cryo has been the pioneer for marine fuel gas systems and has delivered over 40 marine systems.
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LNG pricing compared to Gas Oil & HFO in €/ MWh (March 7, 2018)

- LNG price based on TTF (winter season)
- Gas Oil is 20% more expensive than LNG
- HFO is 17% less expensive than LNG
## The Challenges – The Solutions

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<th>Solutions for</th>
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Exhaust Emissions Diesel vs. Gas
MAN 51/60DF performance, facts & figures

4-Stroke DF engine offers IMO Tier III and SOx compliance in gas mode without any further exhaust after treatment.
Market development

Yearly development of fleet

120 vessels
40 systems by Cryo
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MAN Cryo
Case Study – Port of Gothenburg, LNG Bunkering Pipeline
In June 2017, MAN Cryo signed contract with the Swedish gas distributor Swedegas for the EPC supply of a LNG Bunkering Pipeline, to be installed in the port of Gothenburg.

The intention with the pipeline is to bunker LNG simultaneously while ships are in port for loading/unloading cargo.

The benefit of such a design is to save time, as no additional bunkering operation is needed. The project could also be considered as first step towards a LNG terminal in the port of Gothenburg.

LNG will be supplied by containers or trailers.

On site installation to commence in end of January 2018.
MAN Cryo scope of supply:

- Design engineering
- Procurement
- Construction
- Commissioning

Equipment supply:
2 x Unloading bays for Trailers/Containers
2 x Pump skids incl. Loading hoses
Breakaway couplings
Pressure build up vaporizers for containers
Vacuum insulated piping, 450 meters
Gas buffer vessel for BOG Handling
Control system
2 x Jetty loading hoses incl. Valve skid
ESD Ship-Shore link
MAN Cryo
Case Study – Port of Gothenburg, LNG Bunkering Pipeline

TRAILER/CONTAINER UNLOADING BAY

- Gas buffer
- KnockOut
- Pressure build up
- Trailer/Container
- Pressure build up
- Flowmeter
- Pump (Capacity 50 m3/h)
General project challenges

- Many involved parties
- Reluctancy to use existing infrastructure, such as pipe bridges
- Limited site access, due to constantly incoming vessels
- Installation in Ex-Zones

Design challenges

- Finding a way to handle the accumulated BOG during cooldown of the pipe. => BOG to be received by ship

- Drain the pipeline from LNG to avoid release to atmosphere. => Knock out vessel to force LNG to the receiving vessel
1. Man at a glance
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MAN Cryo
Case Study – LNG trailer fuelgas system – Searoad Mersey II
Due to limited infrastructure for LNG bunkering, SeaRoad initiated talks with DNV already in 2008

"Why not utilize trailers instead of fixed tanks?"

"Then we can skip the bunkering process in the port"

Cryo signed contract with the shipyard, Flensburger Schiffbau in May 2015 for the supply of an LNG fuelgas system

Cryo signed additional contract with SeaRoad in August 2015 for the supply of 7 LNG trailers

Route
Melbourne - Devonport

LNG fuel tank trailers
MAN Cryo scope of supply:

7 x 50 m³ Trailers
Trailer connection box
Gas handling skid
2 Pumps (2 x 100%)
2 Vaporizers (2 x 50%)
1 Heat exchanger unit incl. expansion tank
Interconnecting piping

Classing society: DNV GL
Shipyard: Flensburger Shiffbau
Shipowner: Searoad
Process overview

- Gas feed to engines
- Gas handling room
- Trailer Garage
- Transfer hoses
- Trailer connection box
- Pump
- Pump
- Trailer 1
- Trailer 2
- Trailer 3
Trailer garage

- Garage on aft Weather deck
- Three slots
- Fixation of trailer into ship structure
- Drip tray to handle possible leakage
- Twist lock system for safe handling
Customized LNG trailer

Gross volume: 51 m³
Design pressure: 7 Bar(g)
Approvals:
- DNVGL For Marine use
- Australian road regulations
MAN Cryo
Case Study – LNG trailer fuelgas system – Searoad Mersey II

Trailer connection box

- Steel braided hoses
- Spill free couplings
- Spring balancers
- Vacuum pipes
- Valves and Instruments
Gas Handling room

- Located 1 meter below deck level – Essential to get positive NPSH to the pumps
- 2 Vaporizers (Cryo)
- 2 Pumps (Vanzetti)
- Classed as Tank Connection space
- Built as a skid – Placed in gas handling room
Interconnecting piping

- Double wall & single wall
- Natural gas piping from GHR to GVU (Stainless steel)
- Natural gas piping from GVU to Engines (Stainless steel)
- Vent piping from engines to atmosphere (Carbon steel)
General project challenges
• First time ever, for classing society, shipowner, shipyard & MAN Cryo
• Cultural – Mix of Australians, Germans, Italians and Swedes

Technical challenges
• Trailers are considered as tanks within a marine fuelgas system when connected to ship, otherwise considered as road vehicles => Needs to fulfill requirements from both!
  ➢ Valve closest to tank (class/authority)
  ➢ Check valves in vapour return line (authority)
  ➢ Insulation of king pin (class)
• High pressure drop in main LNG line due to complex routing
• Liquid and pressure in hoses at all times, leads to very stiff hoses that are hard to connect to trailer

Future
• Great potential for retrofit conversions! RoRo & RoPax vessels
Do you have any more questions?

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Thank you